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CALIB. LAB.

OPERATING INSTRUCTION MANUAL

Telonic®

MODEL LD-5 SERIAL #4243

SWEEP-MARKER GENERATOR

Telonic INDUSTRIES, INC. BEECH GROVE, INDIANA

050

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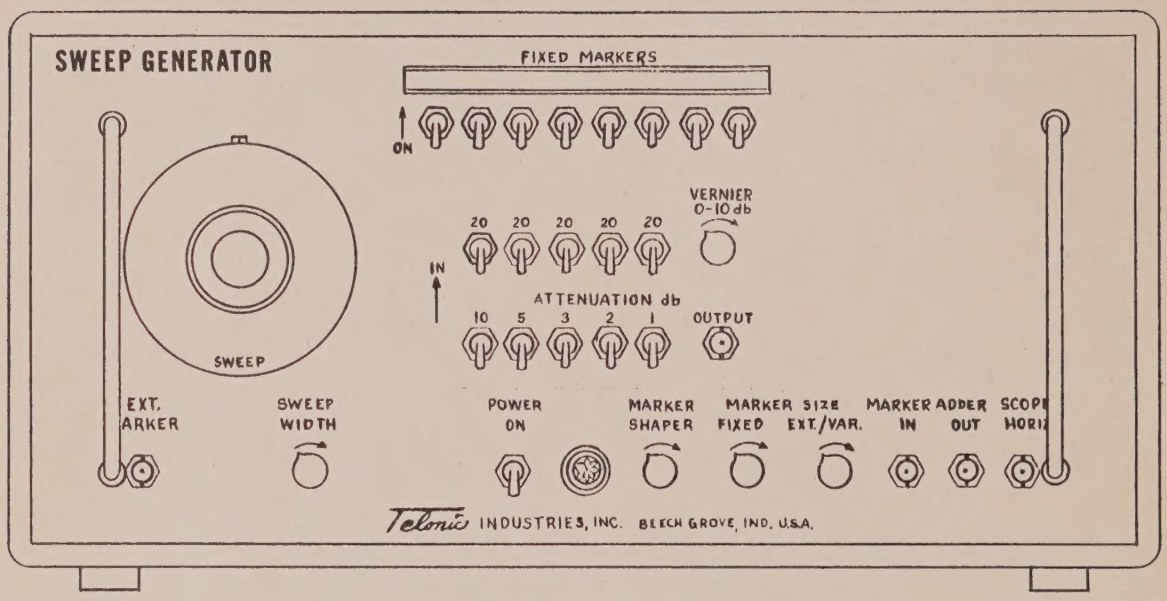
SPECIFICATIONS

MODEL LD-5 SWEEP GENERATOR

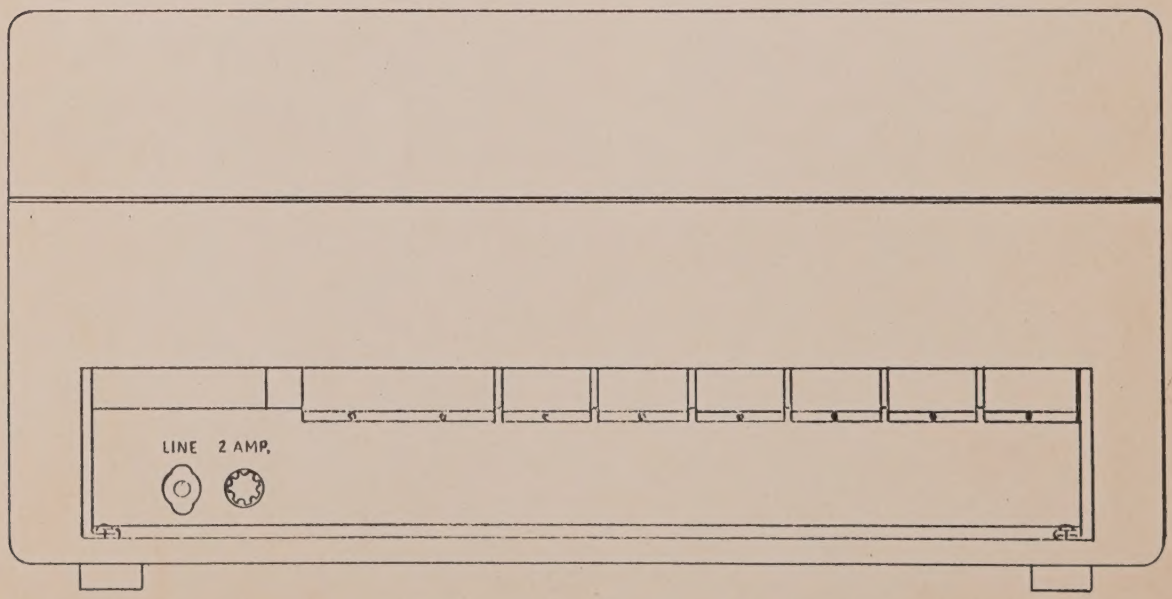
CENTER FREQUENCY	20 - 75 MC
FREQUENCY RANGE	16 - 90 MC
SWEEP WIDTH	.05 - 40%

Note: The Sweep Width is 40% Total (+20% and -20%)

OUTPUT	
Voltage	1 volt RMS.
Impedance	50 ohms.
Flatness	5% over maximum sweep width.
ATTENUATION	
Toggle Switch	20,20,20,20,20,10,5,3,2,1 db.
Vernier	0 to over 10 db.
DISPLAY LINEARITY	Normally below 1.2:1.
RADIATION	Less than 1 microvolt.
SWEEP RATE	Line Frequency (50-60 cps.)
ZERO BASE LINE	Oscillator off 50% of the time during return sweep.
SCOPE HORIZONTAL SWEEP	Approximately 25 volts peak to peak.
SOURCE VSWR	Normally below 1.2:1.
POWER	115 v. 50/60 cps. Approximately 100 watts.
MARKER SYSTEM	
Birdy-By-Pass Marker Circuitry	The outputs of the marker oscillators and the external marker signal are mixed with a sample of the sweep oscillator signal to produce beatnotes or birdies. These birdies are amplified and superimposed upon the detected RF output signal before it is applied to the vertical scope input. Amplitude and width of the markers are adjustable over a wide range.
External Marker Input	An external CW signal of approximately 0.1 volts may be used to produce a "birdy" type marker.
Plug-In Crystal Markers	Provisions are included for up to eight single frequency or harmonic type plug-in crystal-controlled markers. These markers are optional and may be included in this instrument or added at a later date. See our literature for further details regarding these markers.
PHYSICAL DESCRIPTION	Panel Size - 1/8" x 8 3/4" x 19". Chassis Size - 2" x 14 1/2" x 17".


SWEEP GENERATOR
FIXED MARKERS
ON
VERNIER
0-10 db
20 20 20 20 20
IN
ATTENUATION db
10 5 3 2 1
OUTPUT
SWEEP
EXT.
ARKER
SWEEP
WIDTH
POWER
ON
MARKER
SHAPER
MARKER
FIXED
SIZE
EXT./VAR.
MARKER
IN
ADDER
OUT
SCOPE
HORIZ
Telonic INDUSTRIES, INC. BEECH GROVE, IND. U.S.A.

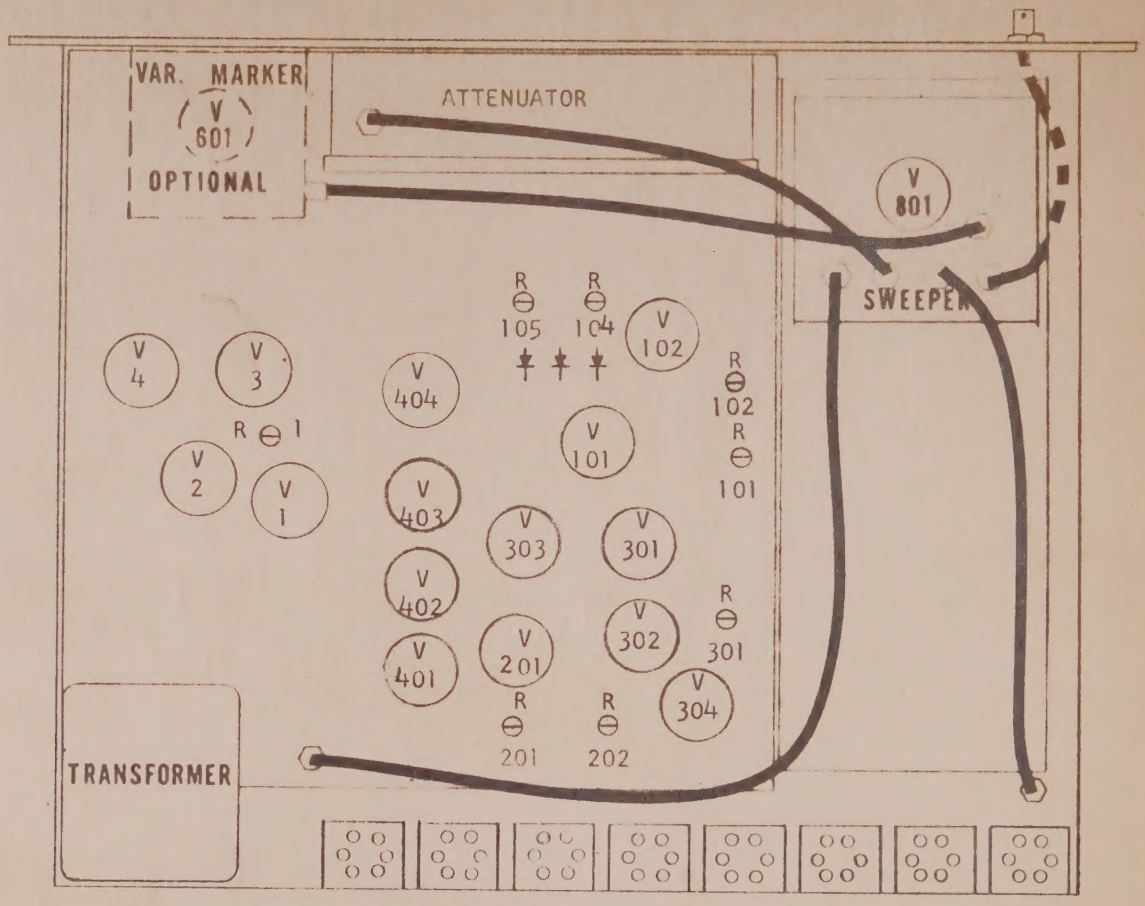
FRONT


LINE 2 AMP.

REAR

DESCRIPTION OF FRONT PANEL

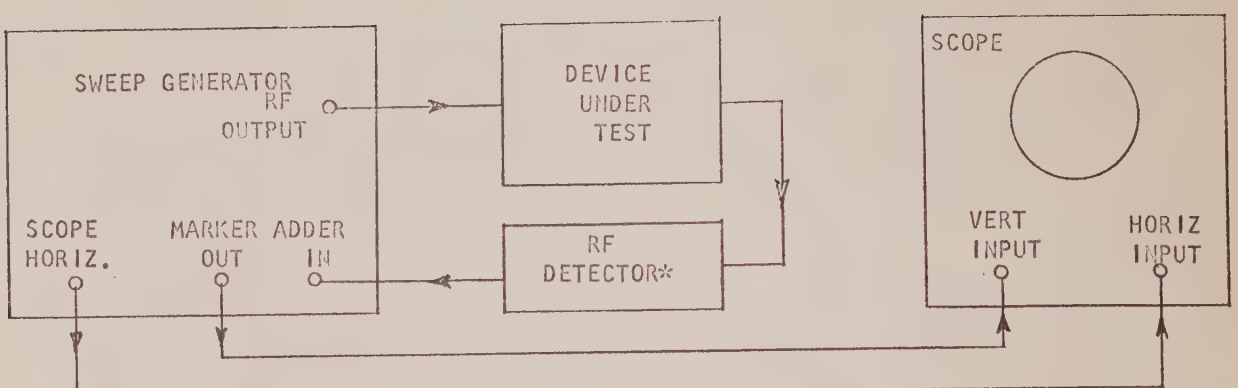
SWEEP DIAL	Indicates Center frequency of the sweep oscillator at minimum sweep width.
VERNIER ATTENUATION	Provides 0-10 db. of vernier attenuation.
TOGGLE SWITCH ATTENUATOR	Provides the indicated amounts of step attenuation.
OUTPUT	RF Sweep Output - BNC Connector - Impedance 50 ohms.
EXTERNAL MARKER	Marker input for external signal source.
SWEEP WIDTH	Varies the amount of drive current supplied to the saturable reactor and can be used to vary the sweep width.
POWER ON	Switches AC power on and off.
MARKER SHAPER	Varies the width of the marker signals.
MARKER SIZE	
Fixed	Varies the amplitude of the fixed markers (crystal plug-in units).
Ext/Var	Varies the amplitude of the external and variable marker signals.
MARKER ADDER	
In	The demodulated signal from the device being tested is fed into this connector so that marker signals may be superimposed.
Out	This connector should be connected to the vertical input terminals of the scope for viewing the demodulated signal and markers.
SCOPE HORIZONTAL	This connector should be connected to the scope horizontal amplifier input.
FIXED MARKERS	These switches supply B+ to the fixed markers (crystal plug-in units) when in the "On" Position.
VARIABLE MARKER (Optional)	
Dial	Calibrated dial indicates the frequency of the marker.
Switch	Supplies B+ to the variable marker when in the "On" Position.



V1	5651
V2	6AU6
V3	EL84/6BQ5
V4	EL84/6BQ5
V101	12AX7
V102	EL84/6BQ5
V201	12AX7
V301	6AU6
V302	12AX7
V303	6AU6
V304	EL84/6BQ5
V401	12AX7
V402	12AX7
V403	12AX7
V404	12AX7
V601	12AV7 (optional)
V801	12AV7

DESCRIPTION OF CHASSIS CONTROLS

R1 - B+2 ADJUST	This control varies the bias on the amplifier, V2, for the B+ regulator, V3, and is adjusted to produce a regulated B+ voltage (B+2) of 175 volts.
R201 - BLANKING PHASE	This control adjusts the phase of the Blanking Pulse with reference to the phase of the Horizontal Sweep Voltage and the Sweep Oscillator.
R202 - BLANKING WIDTH	This control is the grid resistor for the Blanking Pulse Generator, V201. It is adjusted to blank one-half of the sweep cycle to produce a zero base line.
R101 - SWEEP WIDTH LIMIT	This potentiometer controls a voltage supplied to the front panel sweep width control and is used to adjust the sweep width when the front control is set at maximum.
R102 - CENTERING	Controls the average current through the saturable reactor which in turn controls the center frequency of the Sweep Oscillator.
R105 - LINEARITY	Adjusts the Display Linearity of the high frequency side.
R104 - LINEARITY	Adjusts the Display Linearity of the low frequency side.
R301 - LEVEL MAXIMUM	This control adjusts the average B+ voltage supplied to the Sweep Oscillator and is used to adjust the maximum RF Output to a value as shown on the specification sheet.



TYPICAL SET UP - The following procedure is recommended for setting up this instrument in test position.

1. Connect unit to proper power line voltage and turn POWER ON switch to ON position.

2. Make connections to the scope, the device under test, and RF Detector as shown above. All connectors located on the sweep generator are BNC type and it is recommended that RG cable be used for all connections. This insures good ground connection between each device, minimizes hum, leakage from unit and pick up of spurious external signals. The cable that is used to connect the RF OUTPUT to the device under test should match the impedance of the sweep generator. If the input impedance of the device under test is different from the impedance of the sweep generator, a matching network should be used to insure a constant input signal.

3. Adjust the RF output level by means of the OUTPUT LEVEL or VERNIER ATTENUATOR control and the step RF ATTENUATOR to the proper input signal for the device being tested. Failure to do this will result in incorrect reading on the scope.

4. Adjust the SWEEP WIDTH control and center frequency SWEEP DIAL to cover the desired frequency range.

5. MARKERS
   Markers may be produced by one or more of the following methods depending on the specific unit.
   A. Plug-in crystal markers (C type).
   B. Plug-in crystal harmonic markers (CDH or CH type).
   C. Internal variable marker.
   D. External C.W. Signal.
   First turn on marker unit or inject external C.W. signal and adjust MARKER SIZE and SHAPER until markers are of a convenient size and width.

*See Telonic literature for detector recommended for use with this instrument.

INTERNAL CONTROL ADJUSTMENT

THE INTERNAL CONTROLS are adjusted at the factory and normally do not require any readjustment, however, should it be desirable to check these adjustments, follow these Steps:

1 - Connect the unit as shown under operating instructions but omit the device under test. The recommended detector for this unit is the Telonic XD-8 for units with 50 ohm RF output impedance and the Telonic XD-9 for units with 75 ohm RF output impedance. Turn unit on.

2 - B+2 ADJUSTMENT: Adjust R1 to provide a regulated B+ voltage of 175 volts (blue wire).

3 - BLANKING PHASE and WIDTH ADJUSTMENT: Adjust the BLANKING PHASE control, R201, and the BLANKING WIDTH control, R202, to produce a rectangular pattern on the scope.

4 - RF OUTPUT LEVEL ADJUSTMENT: Adjust LEVEL MAXIMUM CONTROL, R301, until the vertical height of the pattern equals the peak to peak RF voltage shown on the specification sheet, Page 1. Since the RF Detector is approximately 90% efficient, the actual RF output voltage will be slightly higher than the voltage shown on the scope.

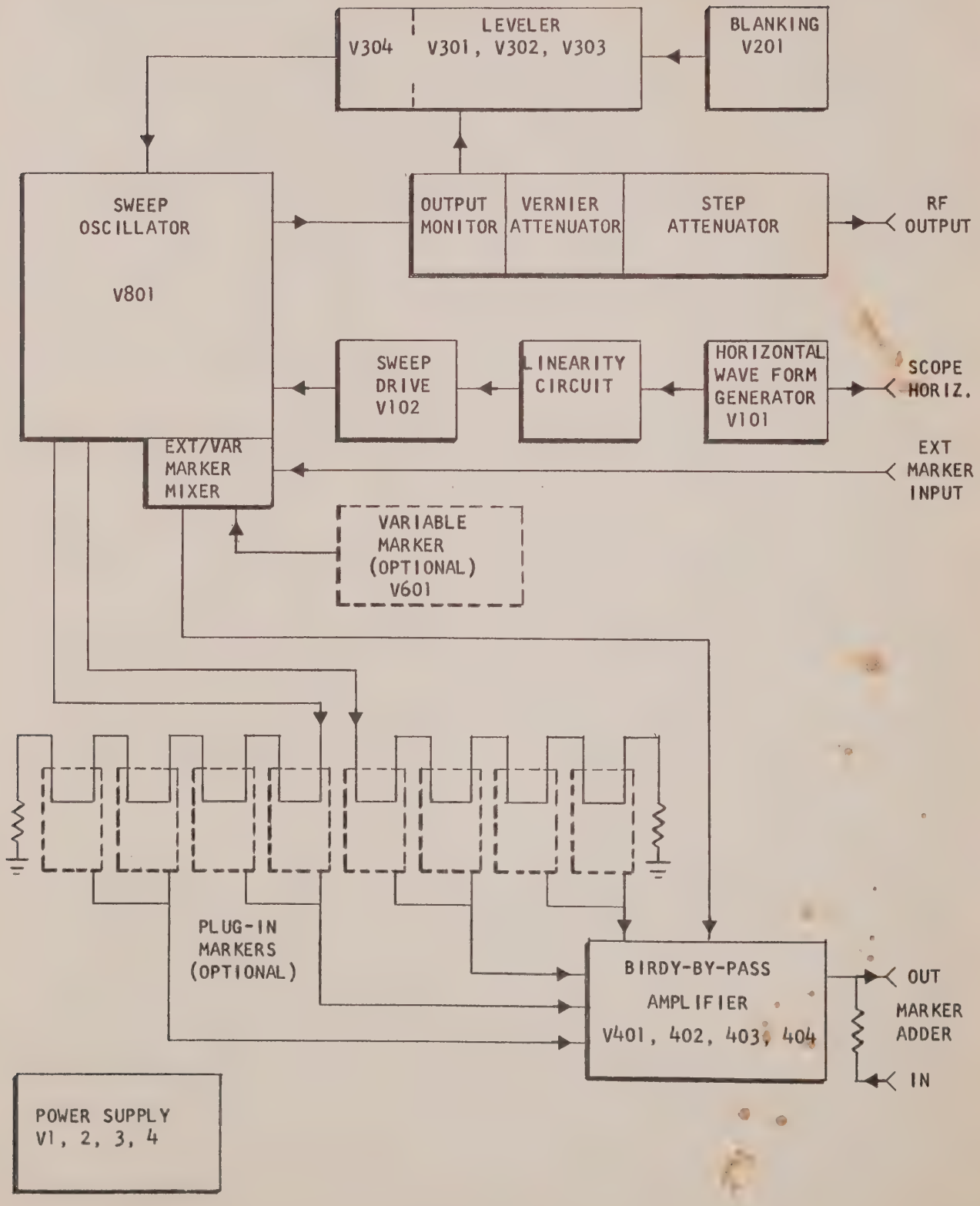
MARKERS MUST BE PROVIDED FOR THE FOLLOWING ADJUSTMENTS

5 - CENTERING ADJUSTMENT: This adjustment can be made indirectly by checking the accuracy of the sweep dial calibration. Set the sweep dial to its mid frequency position and the sweep width control to minimum. The centering control R102 can now be adjusted to correct any inaccuracy in the dial calibration.

6 - SWEEP WIDTH ADJUSTMENT: With the SWEEP WIDTH control on the Front Panel in its maximum clockwise position, adjust the SWEEP WIDTH LIMIT, to provide the maximum sweep width as shown on the specification sheet, Page 1.

7 - Linearity may best be adjusted when a number of markers are present on the display. In the factory, a 1 MC harmonic generator is used for this purpose. The LINEARITY controls are adjusted for equal spacing between the 1.0 MC marker points. This adjustment is to be made at maximum sweep width. Control R105 is used to adjust the high frequency side of the display and Control R104 the low frequency side. Since these adjustments affect the sweep width, it may be necessary to repeat step No. 6.

BLOCK DIAGRAM



SWEEP OSCILLATOR: The sweep oscillator is a fundamental frequency type and uses a saturable reactor to obtain the sweep. This sweep voltage is adjusted to the desired center frequency by varying the oscillator tank capacity with the Front Panel Sweep Dial.

SATURABLE REACTOR: The Saturable Reactor consists of a signal winding and a control winding. The inductance of the signal winding is varied at a 60 cycle rate by the control winding current. This varying current is supplied by the sweep drive tube V102. The average current through this tube is adjusted by varying the bias on the grid by means of the CENTERING control. This current will partially saturate the signal winding and set the operating point of the saturable reactor so that as the current is varied above and below this value, the inductance of the signal winding will also vary linearally above and below its partially saturated value.

LINEARITY CIRCUIT: Saturable reactors exhibit some nonlinearity when operating at maximum sweep width. As the current increases in the control winding and the reactor begins to saturate, the inductance change for a given current change becomes smaller. To correct this, the 60 cycle sawtooth drive voltage applied to the grid of the sweep drive tube is shaped by the linearity circuit which consists of 3 diodes and a biasing network for the diodes. The effect of this circuit is to cause the current in the control circuit to change at a faster rate as the reactor approaches saturation, thus counteracting the slower inductance change.

HORIZONTAL SWEEP AND SATURABLE REACTOR DRIVE VOLTAGE: The sawtooth voltage for the Scope Horizontal Sweep and the Saturable Reactor Drive Tube is produced by V101. A 6.3 volt sinewave is applied to the grid of one of the triode sections of V101. The tube then clips and amplifies the grid signal so that a square wave is produced at the plate. This square wave is then integrated by a RC network in the plate circuit to produce the sawtooth voltage. This sawtooth voltage is then applied to the second triode section of V101, which is connected as a cathode follower and produces the same sawtooth voltage. This voltage is then applied to the horizontal output connector on the Front Panel and to the linearity circuit.

BLANKING CIRCUIT: The purpose of the blanking circuit is to produce a zero base line by removing B+ from the Sweep Oscillator during the sweep retrace. The blanking voltage is originated by a square wave producing circuit. A phased 6.3 volt sinewave is squared and amplified by the blanking tube. This square wave output of V201 controls V304 (EL84), the sweep oscillator voltage regulator tube, and thus deprives the Sweep Oscillator of voltage during one-half of each cycle. PHASE and WIDTH controls are provided for adjusting this blanking voltage to coincide with the horizontal and sweep drive signals.

AUTOMATIC OUTPUT LEVELING CIRCUITRY: The sweep oscillator output is detected by the monitor, amplified in a D.C. amplifier, and used to control the plate voltage of the sweep oscillator. The LEVEL control adjusts the bias on the first stage of the amplifier. This causes the DC levels in the entire amplifier to change, and varies the average B+ supplied to the sweep oscillator from a minimum of 25V to over 100V. A small decrease in the monitor voltage causes a large increase in the B+ supplied to the RF oscillators, and thus counteracts any amplitude variation. The operation of this circuit and of the sweep oscillator can be checked at the feed-thru

capacitor on the end of the Attenuator box or Pin 1 of V301. The waveform at this point will normally show a flat output level over the entire band. Adjusting the LEVEL control will change this level.

The monitor circuit consists of two (2) diodes in a full wave voltage doubler circuit. The use of the full wave detector prevents erroneous leveling information from occurring due to harmonic content and also provides a higher sampling voltage to control the leveling amplifier. The crystal diodes are mounted in such a way as to produce a negative output which is equal to about 75% of the peak to peak RF voltage.

POWER SUPPLY: The power transformer output of 140 volts AC is fed into a half wave voltage doubler, using silicon rectifying elements CR1 and CR2. B+ is taken off the capacity input filter to provide +375 volts unregulated to the plates of V3, (B+ Regulator Pass Tube) V304 (Oscillator Pass Tube) and V4 (Marker B+ Pass Tube).

B+2 is the output of the electronic regulator circuit, consisting of V2 and V3, and provides +175 volts regulated. Potentiometer R1 controls the operating point of V2, regulator amplifier, and is set for proper B+2 output voltage.

B+3 is obtained by biasing the grid of V4 at approximately 85 volts positive, which causes current to flow through cathode resistor R20. The voltage at Pin 3, V4, is supplied to the Plug-In Markers and maintains its regulation due to the low impedance characteristics of the cathode follower circuit and provides approximately 100 volts.

The B- voltage is obtained by the half wave Silicon rectifier CR3. Regulator tube V1 maintains this voltage at -82 volts, and supplies bias voltage to the leveler circuit as well as a reference voltage for the electronic regulator.

Resistor R4 acts as a fuse, protecting the transformer and rectifiers from overload.

The primary of the power transformer is normally wired for 115 volt AC line operation. However, it can be converted to operate from a 230 volt AC source if desired. This conversion is described in the maintenance section.

MARKER SYSTEM DESCRIPTION

GENERAL

A sample of the sweep signal is mixed with the fundamental or a harmonic of the crystal plug-in marker units or external signal to produce beatnotes or birdies. These birdies are then amplified and superimposed upon the demodulated swept signal and applied to the vertical amplifier of the oscilloscope. The size and shape of the marker may be varied over a wide range by the size and shaper control of the birdy amplifier.

EXTERNAL MARKER INPUT

The CW signal from the external marker input is fed into a diode mixer, where it is mixed with a sample of the sweep signal to produce birdies. The resultant birdy is then fed into the birdy-by-pass amplifier.

PLUG-IN MARKERS

This unit has provisions for a maximum of eight single frequency (C Type) crystal markers, eight harmonic (CH type) crystal markers, or four harmonic (CDH type), or any combination. Each CDH type marker occupies the space of two C or CH type.

Two sweep sample outputs are available from the sweep oscillator, in order to minimize coupling between marker signals. For optimum operation harmonic and single frequency markers should not be fed from the same sweep sample line.

SINGLE FREQUENCY MARKERS (C TYPE)

These crystal markers are self-contained plug-in units. Additional units at other frequencies (within the range of the sweep generator) may be ordered and substituted for the original units.

The crystal oscillator units include the tube, crystal, oscillator tuning, crystal diode mixer, and a tuned circuit selecting the sweep input frequency. A test point is provided for easy adjustment of the overtone crystal oscillator (this circuit used above 12 mc.). In making this adjustment, the crystal oscillator coil slug is adjusted for near maximum voltage at the test point. This is usually in the order of 2-5 volts as measured with a VTVM. The adjustment should be made just slightly off the peak on the low inductance side, since the effects of tuning are critical on the other side of the resonance curve. Crystal oscillators below 12 mc. are Pierce type oscillator circuits which require no tuning.

By tuning the sweep sample coil, the frequency of the sweep input signal can be varied and thus minimize unwanted markers generated from other harmonic of the crystal oscillator. The amplitude can be varied by adjusting the coupling.

MARKER SYSTEM DESCRIPTION (Continued)

HARMONIC MARKERS

Harmonics of a crystal-controlled oscillator are mixed with a portion of the sweep signal to produce a display of markers at regular intervals across the sweep range.

CH TYPE - This type utilizes a single tube and produces harmonic markers over a limited range.

CDH TYPE - This type uses two tubes and therefore will produce harmonics over a much larger range than the CH type. For example the CH type, 1 mc., harmonic generator will produce harmonic markers to approximately 25 mc. where the CDH type, 1 mc., harmonic generator will produce markers to over 300 mc.
(See our literature on plug-in markers for additional information).

MAINTENANCE

POWER SUPPLY: Since a defect in the power supply will affect all circuits, it should be checked for proper operation before proceeding to other circuits.

SUPPLY	NOMINAL VALUE	NORMAL VARIATION	NORMAL RIPPLE	WIRE COLOR*
AC Line	115V	---------	------	------
B+1	375	±15 volts	6 to 15 volts	Red
B+2	175	±.5 volts	12 to 25 millivolts	Blue
B+3	100	+5-10 volts	15 millivolts to .5 volts	Orange
B-	-82	±2 volts	100 millivolts	White
6.3 "A"	6.3V AC	Main filament supply		Heavy Duty Green
6.3 "B"	6.3V AC	180° out of phase with supply "A". Source of phasing and filament voltages.		Heavy Duty Gray
6.3 "C"	6.3V AC	Isolated filament voltage for tubes with cathodes above ground.		Heavy Duty Brown

Next: If power supply is operating normal, use the block diagram to isolate the trouble to a major section. Check tubes, diodes, and adjustment of Front Panel and printed wiring board controls located within that section (see Page 7 for adjustment procedure). By the use of the schematic, ordinary difficulties encountered can be readily located and remedied. The following trouble-shooting chart is an additional aid to servicing:

SYMPTOM	POSSIBLE CAUSE AND REMEDIES
Pilot Light Off and Unit Fails to Operate	Fuse open - replace. If second fuse opens - look for cause of overload, shorted wiring, components, etc.
B+1 Off Value or Excessive Ripple	Check R4, C1, CR1, and CR2.
B+2 Off Value or Excessive Ripple	Check R1 for proper adjustment. Check R15, it will burn out if B+2 is overloaded. Check V1, V2, V3, tubes and circuitry.
B+3 Off Value or Excessive Ripple	Check R17 and R21 (these resistors adjust the voltage on the grid of V4, a cathode follower, which in turn determines the voltage on the cathode). Check R18 (this resistor will burn out if B+3 is overloaded). Check V4 and C2.
B-Off Value or Excessive Ripple	Check C3, C4, C5, CR3, R3, R5, and R6. Check V1 to see if it is lit properly (should be a steady orange glow).
V1 Not Lit Properly	If replacing V1 and checking the above parts does not remedy the trouble, check the line voltage. Low line voltage could cause this trouble. Reducing the value of R3 slightly will usually eliminate this difficulty.

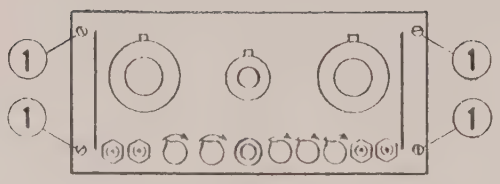
*Wire colors do not apply to shielded wires - single wires only.

R.F. Output is Low or Zero	Check R313 - this resistor will burn out if the B+ to the sweep oscillator is overloaded. Check B+ to the sweep oscillator, cathode of V304. It should be a positive square wave of 25-100 volts and should vary as the OUTPUT LEVEL control varies. If it is normal, look for RF difficulties, defective tube, components, shorted or open wiring, etc. If the voltage is low and does not respond to the LEVEL control, remove first V303 and then V201. When either of these tubes conducts, the voltage on the grid of V304 (pin 2) is reduced and thus decreases the B+ to the sweep oscillator. If removal of V201 allows the B+ on V304 (pin 3) to return to normal, check the blanking tube, controls, and associated circuitry. If removal of V303 causes the B+ to return to normal, check the LEVELER controls, V301 and V302, tubes, and associated circuitry.
Poor Leveling	Replace monitor diodes. Also replace V301, V302, and V303. V301 is the most critical since it is in the first stage of the D.C. coupled amplifier. Resetting the printed circuit LEVEL controls is sometimes necessary if these tubes are replaced.
Weak Markers	Replace 1N82 or 1N34 crystal diode mixer. Check Birdy-By-Pass Amplifier, tubes and circuitry.
No Horizontal Output	Look for difficulty in the sawtooth circuitry V101.
Insufficient Sweep Width	Check adjustment of CENTERING and LINEARITY controls. (See Page 7).
Poor Display Linearity	Check diodes CR101, 102, and 103. Check LINEARITY controls. (See Page 7).
Sweep Dial Off Calibration	Check adjustment of CENTERING control. (See Page 7). Replace sweep oscillator tube V801

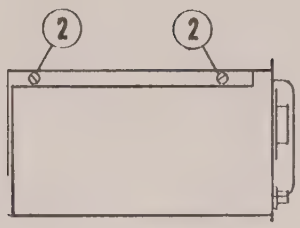
CONVERSION FOR 230 VOLT POWER LINES

The dual primary of the power transformer is normally wired in parallel for use on 115 volt AC lines. If desired, the windings can easily be reconnected in series for use with 230 volt power. With the aid of the Chassis Layout, bottom view, locate terminals 1, 2, 3, and 4. Remove the jumper wires between terminals 1 and 2 and between terminals 3 and 4. Then install a jumper wire between terminals 2 and 3.

RACK MOUNTED UNIT



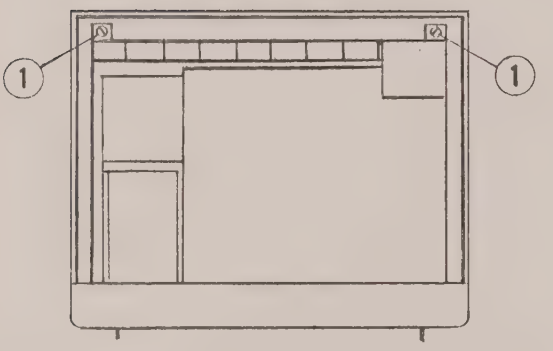
FRONT



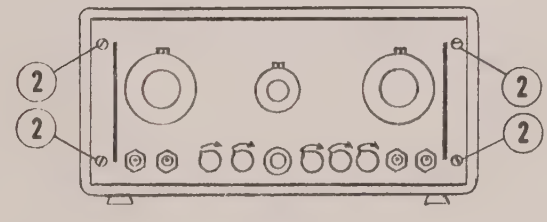
SIDE

Unit has front panel slotted or drilled for standard RTMA Mounting. Position unit in rack and install mounting screws in holes marked (1).
Dust cover removal: Remove four #8-32 thread-cutting screws, marked (2) (two on each side) and lift off cover for easy access to chassis.

CABINET MOUNTED UNIT



TOP



FRONT

To remove chassis from cabinet; first remove the two #8-32 screws (marked (1) on top view above) at the back of the chassis (one on each side). These screws fasten the chassis to the cabinet guide rails. Second, remove the four #10-32 screws (marked (2) in front view above). The screws hold the panel to the cabinet.

Slide chassis out of cabinet by pulling forward on the two front panel handles.

To replace chassis in cabinet, insert the flanges on the bottom of the chassis side panels into the slot of the cabinet guide rails. Push chassis back into cabinet far enough for the slots in the side panel flanges to align with the retained nut in guide rail. Install the two #8-32 screws and tighten securely. Replace the four #10-32 screws in the front panel.

PART VALUE INFORMATION

SCHEMATIC PART DESIGNATION		SCHEMATIC VALUE ABBREVIATION	
C	Capacitor	Ω	ohms
CR	Crystal Rectifier, Germanium Diode	KΩ	1,000 ohms
F	Fuse	MΩ	1,000,000 ohms (megohms)
I	Incandescant Pilot Light		
J	Jack or termination, Coaxial Connector	μf, uf	Microfarad
K	Cable	μμf, uuf	Micromicrofarad
L	Coil	μh, uh	Microhenry
M	Meter or Motor	mh	Millihenry
P	Plug, Coaxial Connector		
R	Resistor, Fixed or Variable		
S	Switch		
T	Transformer		
V	Tube		
Z	Miscellaneous		

RESISTORS - All resistors are $\frac{1}{2}$ watt ± 10%, and are shown in ohms, unless otherwise specified.

NOTE: Resistors in the attenuator pads are ± 2%.

CAPACITORS - All capacitors are shown in micromicrofarads (uuf) unless otherwise specified.

COILS - All coils are shown in microhenries (uh) unless otherwise specified.

PARTS LOCATION - F.P. Front Panel
P.C.B. Printed Circuit Board
R.P. Rear Panel
C.H. Chassis
T.P. Test Point

PARTS NUMBERS - LOCATION INFORMATION

1 - 99 - Power Supply
101 - 199 - Horizontal and Sweep Drive Circuit
201 - 299 - Blanking
301 - 399 - Leveler
401 - 499 - Birdy-By-Pass
501 - 599 - Mixer & Plug-In Markers
601 - 699 - Variable Markers
701 - 799 - Attenuators
801 - 899 - Sweep Oscillator
901 - 999 - Modification & Special Circuits

*Indicates value of component adjusted at factory, and may deviate from value shown on print.

—○— Indicates printed circuit board terminal.

N O T I C E

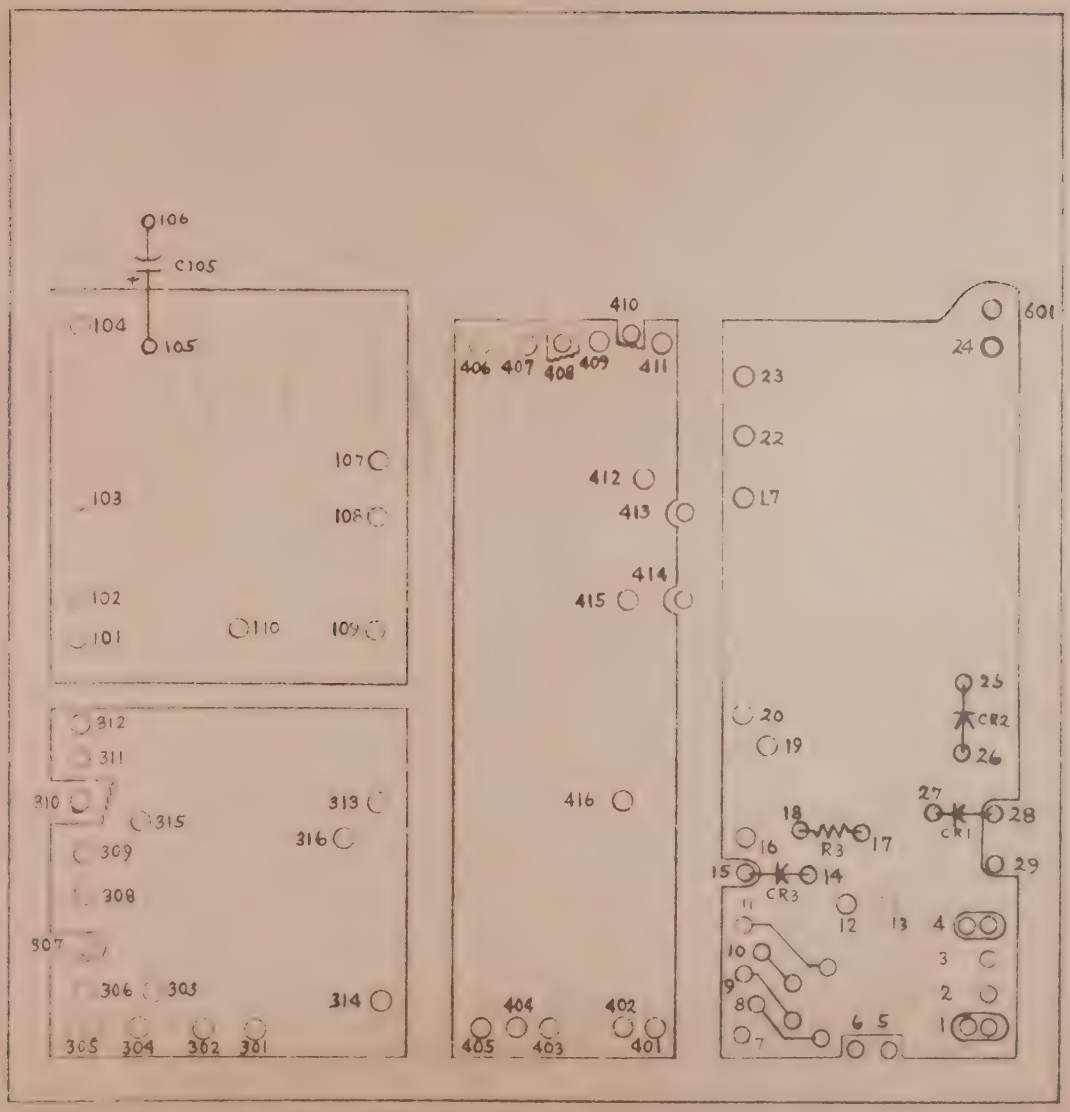
RED LACQUER IS USED TO INDICATE FASTENINGS THAT SHOULD NOT BE DISTURBED FOR ORDINARY SERVICE, AND TO SECURE ADJUSTABLE CONTROLS.

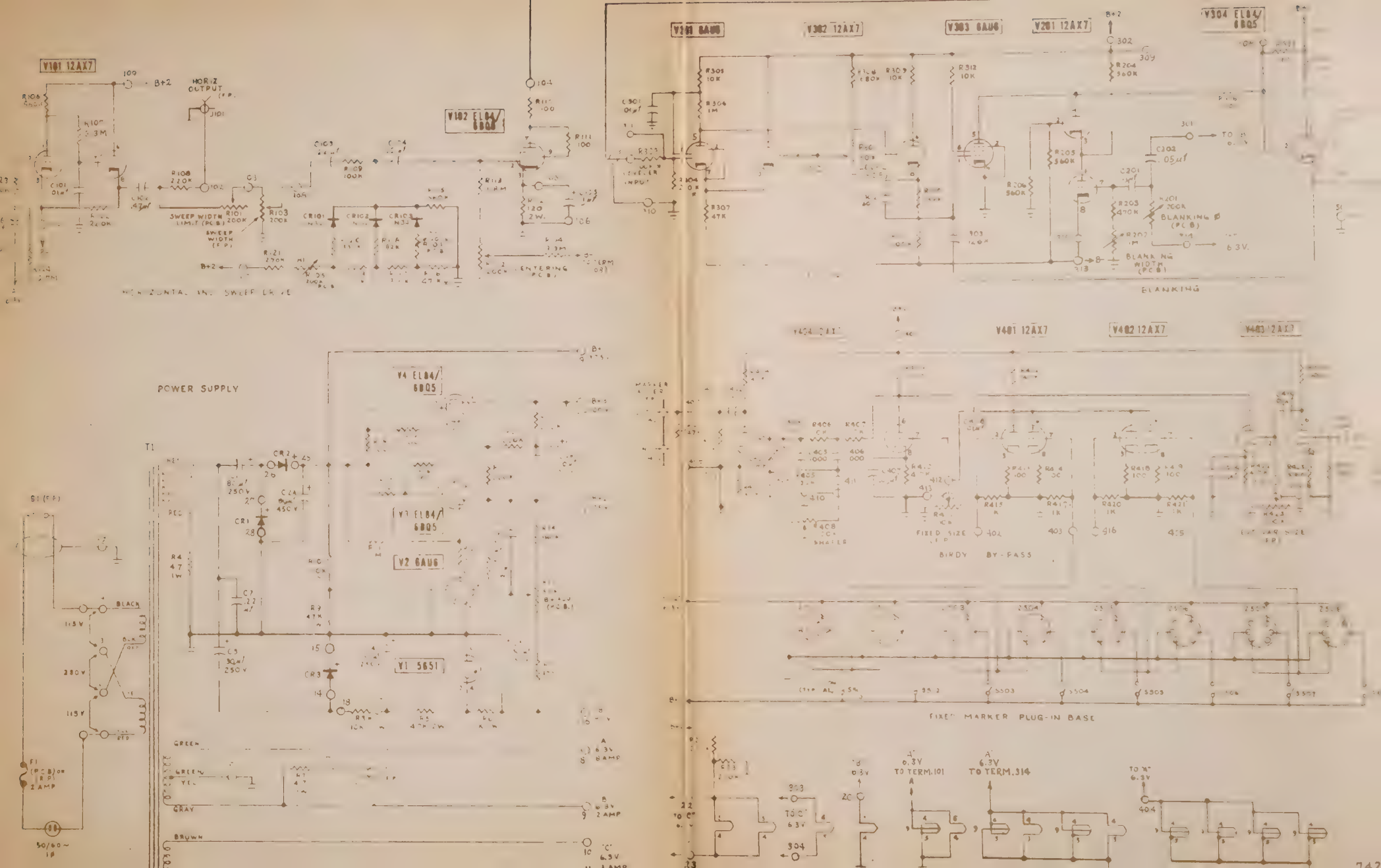
CHASSIS LAYOUT

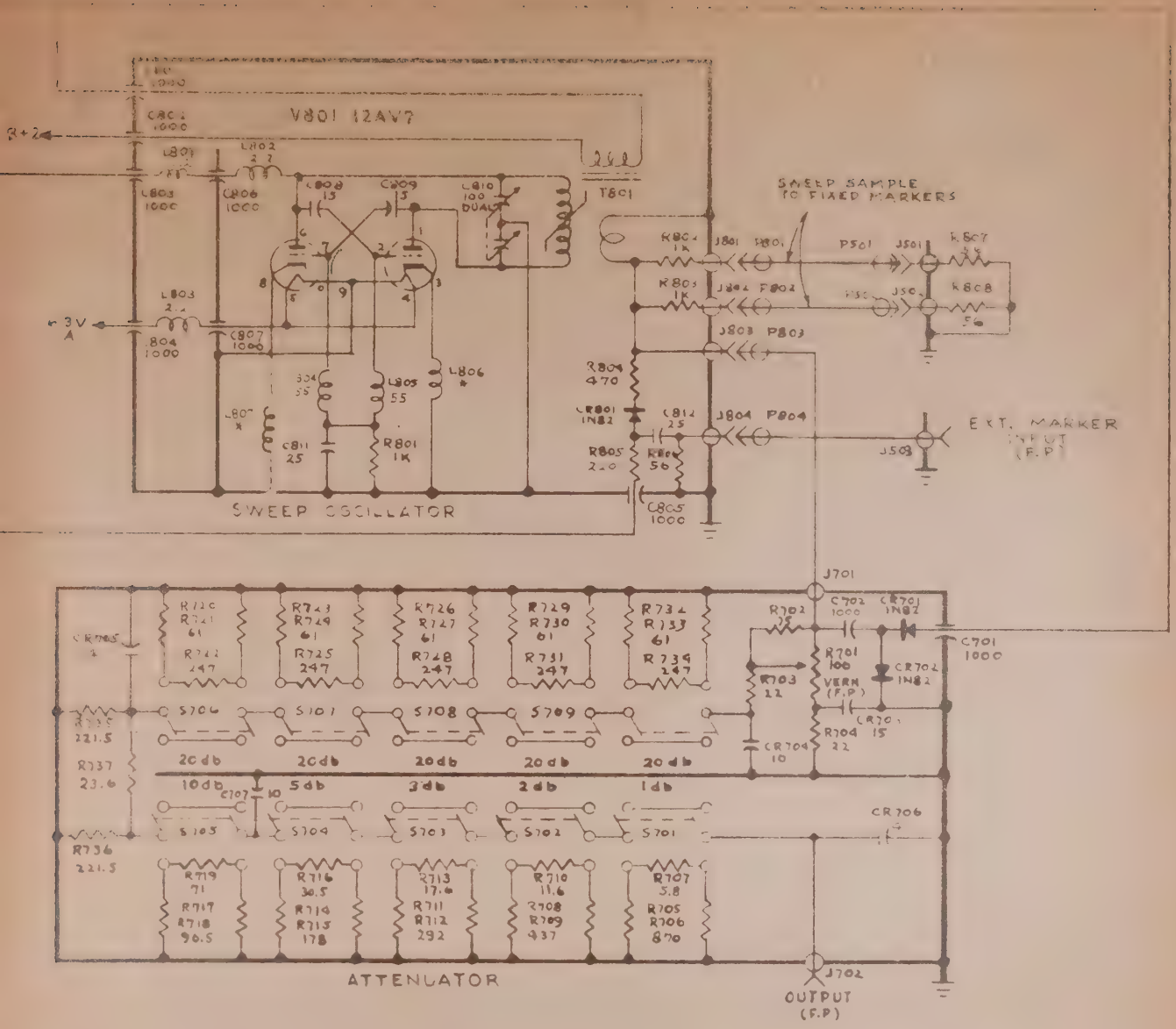
BOTTOM VIEW

TERMINALS

FRONT




V101 12AX7
V102 ELB4/6BQ5
V301 6AU6
V302 12AX7
V303 6AU6
V201 12AX7
V304 ELB4/6BQ5
V404 12AX7
V401 12AX7
V402 12AX7
V403 12AX7
V4 ELB4/6BQ5
V2 6AU6
V1 5651
HORIZ OUTPUT
SWEEP WIDTH LIMIT (PCB)
SWEEP WIDTH (FP)
HORIZONTAL INT. SWEEP DRIVE
POWER SUPPLY
BLANKING
BLANKING Ø (PCB)
BLANKING WIDTH (PCB)
BINDY BY-PASS
FIXED SIZE (FP)
FIXED MARKER PLUG-IN BASE
TO TERM.101
TO TERM.314
TO TERM.404
ENTERING (PCB)
B+2
B+
6.3V.
115V
230V
50/60~
1Ø


V801 12AV7
SWEEP SAMPLE TO FIXED MARKERS
EXT. MARKER INPUT (F.P.)
SWEEP OSCILLATOR
J701
J702
OUTPUT (F.P.)
ATTENUATOR
20db
20db
20db
20db
20db
10db
5db
3db
2db
1db

WARRANTY

TELONIC INSTRUMENTS AND ACCESSORIES

Products manufactured by TELONIC INDUSTRIES, INC. are guaranteed against defective materials and workmanship for a period of one year (vacuum tubes excepted) from date of purchase. This warranty does not apply to instruments that have been altered, improperly handled or damaged in any way beyond our control.

Instruments must be examined immediately upon receipt, since claims for damage in transit will not be honored by the carrier unless prompt action is taken.

CHANGES IN SPECIFICATIONS

The right is reserved to change the published specifications of equipment at any time, and to furnish merchandise in accordance with current specifications, without incurring any liability to modify equipment previously sold.

RETURNING EQUIPMENT TO FACTORY

Factory service is available for repair and readjustment of this instrument. However, a description of the trouble, plus the MODEL AND SERIAL NUMBERS of the unit should be forwarded FIRST, whereupon instructions for correcting the trouble OR authorization for returning the equipment will be given. This applies to all units, whether under warranty or not.

SWEEP GENERATORS

Telonic®

CATALOG S-B

for precise measurement of frequency response . . .

. . . in the laboratory

. . . on the production line

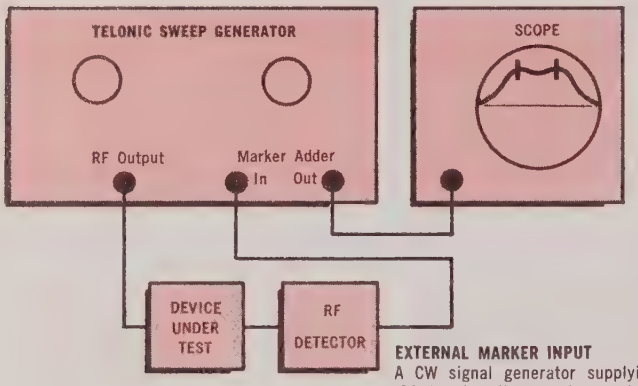
- *Sweep Generators*
- *Marker Equipment*
- *RF Attenuators*
- *RF Detectors*
- *RF Filters*

Telonic INDUSTRIES, INC. BEECH GROVE, INDIANA

BIRDY-BY-PASS MARKER SYSTEM

In this system, beat or birdy pips are produced by mixing a sample of the sweep oscillator signal with the marker output. The "birdies" are fed through an amplifier and are added to the demodulated sweep signal before it is connected to the scope vertical amplifier. The markers completely bypass the device under test.

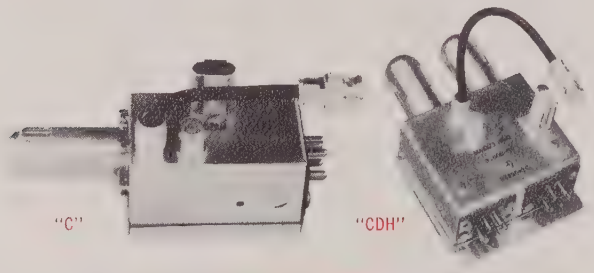
Since the markers are produced directly, no frequency error can occur other than in the marker oscillator itself. In addition to accuracy it features — stability, versatility and simplicity.



EXTERNAL MARKER INPUT
A CW signal generator supplying .01 to .1 volts may be used to produce a variable marker.

Eight plug-in sockets are included on the chassis of the HD, LD, SD, LR and ED Sweep Generators. Eight ON/OFF switches are also mounted on the front panel. This permits mounting up to eight of the "C" and "CH" type markers, up to four "CDH" type, or a combination of the plug-in types.

The "C" unit makes use of crystals up to 60 mc and generates a *single* marker by use of frequency selective circuits that combine the approximate harmonic with the swept signal sample in a diode mixer. Single markers can be produced to as high as 1250 mc.



PLUG-IN MARKERS

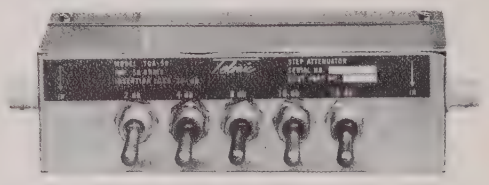
The selective circuits of the "C" unit are omitted in the "CH" units; thus a marker is produced at each harmonic of the crystal. The amplitude of the harmonics decrease therefore limiting the usefullness of the "CH" units to between the 10th or 15th harmonic.

The "CDH" circuit includes two dual triodes to greatly extend the range of harmonics. These units maintain a relatively constant level to as high as the 200th harmonic. Crystal frequencies of from 0.5 to 10 mc are normally used. Since an untuned type of oscillator circuit is used, frequency depends solely upon the crystal used.

BULLETIN No. T-218

RF ATTENUATORS

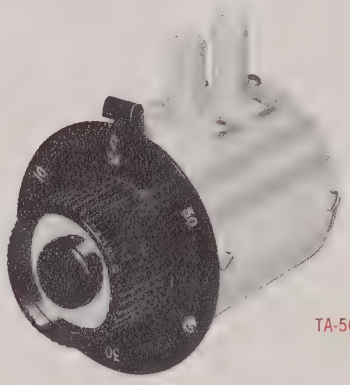
Telonic RF Attenuators are available in two forms: toggle switch and turret. The toggle switch type is recommended in the frequency range, 0-250 mc. Turret attenuators may be used to 1,250 mc. Connectors are BNC type.



TGA-50 STEP ATTENUATOR

Toggle Switch Attenuators are supplied in standard models containing 3 to 11 steps, with 0.5 to 30 db attenuation per step. Resistor accuracies may be selected at 0.5, 1, or 2%; impedances at 50, 75, or 93 ohms. A 3-step unit measures 1¾" by 1¾" by 3½". Additional steps add ¾ inch for each.

BULLETIN No. T-201

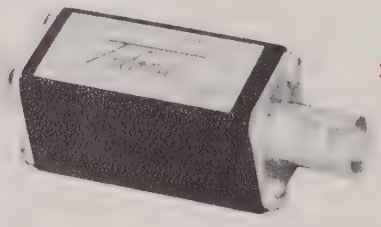


TA-50 TURRET ATTENUATOR

THE TELONIC MODEL TA-50 TURRET ATTENUATOR is a highly accurate, six-position unit providing 0, 10, 20, 30, 40 and 50 db attenuation of RF signals from DC to 900 mc and above.

Other Telonic Turret Attenuators are available that provide accurate attenuation in the 0-5, 0-10 and 0-25 db ranges.

BULLETIN No. T-212



XD-3 RF DETECTOR

Telonic RF Detectors are used whenever the circuit under test lacks "built-in" demodulation or "look" points. The Telonic RF Detectors are available in a wide range of impedance values. The complete unit includes a termination resistance, an easily replaced crystal diode, and a low pass filter to remove RF from the DC output.

Model XD-3 is a 1-1250 mc detector generally recommended for use with the HD-1, HD-3 and SD Telonic Sweep Generators. Model XD-8 is recommended for use with the HD-4, HD-7 and LD Telonic Sweep Generators, and in all applications involving the frequency range 1-250 mc.

BULLETIN No. T-204

Telonic INDUSTRIES, INC.
BEECH GROVE, INDIANA

Technical Catalog No. T-203B

Telonic

SWEEP GENERATORS

for TELEVISION PRODUCTION TESTING & ALIGNMENT

Courtesy of Standard Coil Company, Chicago, Illinois

- For the production line or engineering laboratory
- Models to meet every TV standard: U. S., European, Italian, Australian, etc.
- Frequencies to cover UHF, VHF and IF ranges
- Built-in markers indicate audio and video frequencies and other alignment points as required
- Rugged construction for long, trouble-free life
- Used in nearly every country where TV sets are made

Telonic INDUSTRIES, INC.
BEECH GROVE, INDIANA

Telonic

TELEVISION-TEST INSTRUMENTS AND ACCESSORIES

For nearly a decade, and in every major country in the Free World, Telonic sweep generators and related devices have set the standard of excellence in plants where TV sets and components are made.

Telonic's TV-test instruments are designed specifically for the production line. In the case of VHF instruments, operators may move from channel to channel by turning a single switch, and the display automatically changes from one frequency range to the next, including the markers for both the audio and video points. No time is lost in adjusting the test instrument while tuning and aligning circuits and components.

Models are available to meet every commercial television standard, including all those now in use in the United States, England, France, Germany, Italy, Australia, Japan and virtually every other nation. In addition, Telonic's engineering staff is prepared to adapt instruments to meet special operating or performance requirements.

The simplicity and rugged design of the Telonic units guarantees long, trouble-free life and easy maintenance. Epoxy-glass circuit boards are used throughout, with extra heavy copper-foil leads etched in Telonic's own printed-circuit production facility. The channel-selector switch contacts are of solid silver to provide years of operating life without replacement.

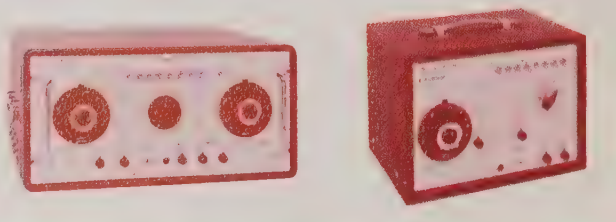
FOR UHF SERVICE . . .

The Telonic SD-3M, SD-3 and SN-3 Sweep Generators are ideal instruments for evaluating and adjusting circuits in the UHF range. New sweeping techniques have resulted in highly reliable devices capable of producing exceptionally flat, high-level outputs over the entire frequency range of 425-930 mc.

Approximately 10% of this range is swept with a single setting of a calibrated center-frequency dial on the front panel of each instrument. The dial provides infinite resolution of the swept frequency, allowing a single instrument to perform most of the aligning jobs required in the tuning of UHF circuits and components.

The sweep oscillator circuitry is contained in a tightly sealed compartment that reduces radiation to less than 10 microvolts. This eliminates the danger of errors created by transmitted RF signals between adjoining test stations. The oscillator itself is swept by a precision vibrating capacitor consisting of a silver-plated berryllium copper diaphram that will not warp or fatigue. The exceptional flatness of the instrument across the entire UHF range is achieved by a feedback monitoring system that controls the B+ voltage to the oscillator.

Up to eight plug-in markers may be added to the instrument to produce birdy-type marks or pips on the oscilloscope trace. The marker frequencies are added to the demodulated signal as it enters the oscilloscope, bypassing the circuit being tested. The plug-in marker units contain a crystal-controlled oscillator with an accuracy of .005%. Harmonic markers producing birdies at intervals and a variable marker covering the entire swept range are also available as optional equipment.



SD-3M (with variable marker)
SD-3 (without variable marker)

The panel size of these models is suitable for rack mounting and may be ordered with or without a cabinet. Up to eight plug in markers may be included.

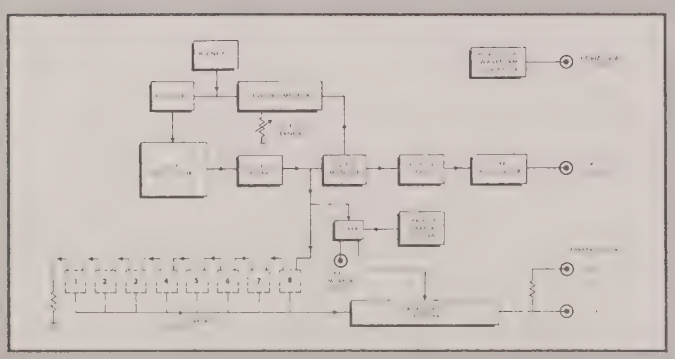
SN-3

This smaller, lighter style is suggested for portable use or for production line use where space is limited. Up to eight plug in markers may be included.

SD-3 OR SN-3 SPECIFICATIONS

SWEEP WIDTH	CENTER FREQUENCY RANGE	SWEPT RANGE
.02 — 10%	440-920 mc.	425-930 mc.

Maximum output — over .75 volts RMS into 50 ohms.



Flatness	5% over maximum sweep width (into 50 ohm load)
Attenuation	Turret Attenuator, 0, 10, 20, 30, 40, 50 db, plus 0-1 vernier
Zero Base Line	Oscillator off during retrace
Scope Horizontal Sweep	Approximately 20 volts, peak to peak
Radiation	Less than 10 microvolts
Source VSWR	Normally below 1.3:1
Display Linearity	Better than 1.2:1
Power	115/230 volts, 50/60 cps, 120 watts
Sweep rate	Line Frequency (50/60 cps)
Marker System	Birdy-By-Pass System, external marker input, provisi for 8 plug-in markers (See Bulletin Cat. 8B & T-218)
Variable Marker (optional)	.25% accuracy (model SD-3M)
Recommended Accessories	Telonic XD-3 RF Detector Telonic CDH-10 Harmonic Marker (10 mc. harmonics Telonic "C" type fixed frequency Plug-in Markers
Physical Description	SD-3 and SD-3M Cabinet, 10" x 20" x 15" hinged to Panel, 8¾" x 19" Chassis, 2" x 14½" x 17" SN Cabinet, 10" x 14" x 10"
Shipping Weight	SD-3 and SD-3M-60 lbs./SN-35 lbs.

FOR VHF TELEVISION PRODUCTION . . .

The Telonic SV-SERIES Sweep Generators are used by a majority of the TV equipment manufacturers including RCA, General Electric, Admiral, Oak, F. W. Sickles, and Standard Coil and many other companies in the U. S., CANADA, EUROPE and other parts of the world.

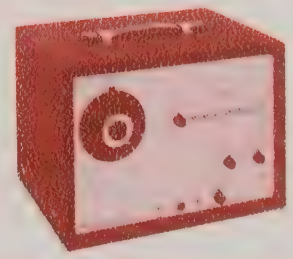
Hundreds of units in continuous service over a number of years have proved the reliability and efficiency of the Telonic instruments. Their high level output, wide and flat sweep characteristics, and accurate marker system have made them a valuable asset both on the production line and in the engineering laboratory.

The SV-SERIES feature a modular construction that makes them especially easy to maintain and service. Front-panel controls are designed to reduce any chance of operator error; markers and swept-frequency range are changed by the movement of a single black-anodized dial marked with 12 VHF channel numbers plus an IF channel for checking IF circuits. BNC connectors are used for greater convenience and standardization of connecting cables.

Sweeping is accomplished by magnetically saturating a ferrite core to change the inductance of the oscillator tank circuit. The particular ferrite used has characteristics that produce a very linear frequency change. Crystal controlled oscillators are used to produce two pulse markers on the sweep pattern, one at the video and the other at the audio frequencies of each channel. The marker pulses are used internally to amplitude modulate the sweep output or externally to produce intensity markers or sharp rectangular spikes on the scope presentation, independent of the circuit under test.

The output is extremely flat over the entire sweep width; flatness is better than 5% over each channel and within 1 or 2% between markers. This flatness is obtained by the use of voltage doubler detector circuit which samples the complete RF output envelope. A three stage high gain DC-coupled circuit amplifies any deviation of this detected signal and compensates for it by instantaneously changing the B+ to the sweep oscillator. The result is a stable, flat output with excellent long and short time stability, unaffected by aging of parts or line voltage fluctuations.

Standard VHF Sweep Generators are portable models in a black-wrinkle cabinet. Specifications for the various models are shown below.



Models SV-7, 8, 9, 10 replace the SV-6 series and include the optional features of the SV-6ADEG as standard equipment. This includes the extra 40 db attenuation, 115/230 Volt — 50/60 cps operation, RF monitor and includes sweep width and centering controls on the front panel.

SPECIFICATIONS

Sweep Width	25 mc. max. with front panel control and individual adjustments (14 mc. max. at I. F.)
Output	.75 volts RMS into 75 ohms
Flatness	±1% between marker ±2.5% over each channel ±5% over all
Attenuation	99 db plus 10 db vernier (Steps are 20, 20, 20, 20, 10, 6 and 3 db)
RF Monitor	A diode detector is furnished at the output for making VSWR measurements
Markers	Pulse markers appear at the video and sound carrier frequencies
Zero Base Line	Oscillator off during return sweep
Scope Horizontal Sweep	Approximately 20 volts peak to peak
Radiation	Less than 10 μ volts
Source VSWR	1.3:1 max.
Display Linearity	1.2:1
Sweep Rate	Line Frequency (50/60 cps)
Power Requirements	Approx. 100 watts
Physical Dimensions	10" x 14" x 10"
Shipping Weight	Approx. 35 lb.

Marker Freq. in Megacycles

American SV-7

Channel	Video Marker mc.	Sound Marker mc.
1F	45.75	41.25
2	55.25	59.75
3	61.25	65.75
4	67.25	71.75
5	77.25	81.75
6	83.25	87.75
7	175.25	179.75
8	181.25	185.75
9	187.25	191.75
10	193.25	197.75
11	199.25	203.75
12	205.25	209.75
13	211.25	215.75

Italy SV-8

Channel	Video Marker mc.	Sound Marker mc.
IF	45.75	40.25
A	53.75	59.25
B	62.25	67.75
C	82.25	87.75
D	175.25	180.75
E	183.75	189.25
F	192.25	197.75
G	201.25	206.75
H	210.25	215.75
I	218.75	224.25

Europe SV-9

Channel	Video Marker mc.	Sound Marker mc.
IF	38.9	33.4
2	48.25	53.75
3	55.25	60.75
4	62.25	67.75
5	175.25	180.75
6	182.25	187.75
7	189.25	194.75
8	196.25	201.75
9	203.25	208.75
10	210.25	215.75
11	217.25	222.75

Australia SV-10

Channel	Video Marker mc.	Sound Marker mc.
IF	36.0	30.5
1	50.25	55.75
2	64.25	69.75
3	86.25	91.75
4	133.25	138.75
5	140.25	145.75
6	175.25	180.75
7	182.25	187.75
8	189.25	194.75
9	196.25	201.75
10	210.25	215.75

OPTIONAL FEATURES

The basic SV-7 Sweep Generator may be adapted to a number of special purposes by taking advantage of the optional features that are described below. When ordering, be sure to indicate the modifications desired by adding the modification letter or letters to the model number. Thus an SV-7 unit with a dual attenuator and an extra marker on the IF would be designated as a Telonic SV-7BC Sweep Generator.

F Other frequency standards

B A dual attenuator having steps of 20, 20, 10, 6, 3, db on each section. The input of each attenuator is common. This arrangement is used to make connections to a fixture for both IF and RF testing of TV front ends for dual trace presentation for comparison to a standard unit.

C An extra marker on the IF position.

I The Telonic Birdy-by-Pass system may be added to any SV model, permitting the addition of up to eight fixed markers anywhere within the range of this instrument. (If needed, please state requirements and request information and quotation.)

S Special features. Other modifications, not mentioned above, may be requested.

SPECIAL MODELS

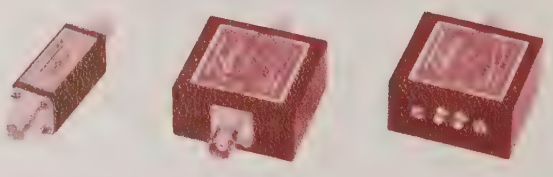
An outstanding special model, the SPI-10 (designed for LUXOR in Sweden).

This model is mounted in the bench style cabinet and includes either the SV-7, 8, 9 or 10 specifications plus a number of special features including a calibrated variable marker and CW output over the IF range; 2 sets of harmonically related markers, up to 8 fixed markers, external marker input, Birdy-By-Pass System and other refinements.

VHF BALUN

BA-1
Channel 2-13
75 to 300 ohms
BNC input
Special output

RF DETECTORS



SPECIFICATIONS	XD-3	XD-9	XD-10
Frequency range	1-1000 mc.	1-250 mc.	1-250 mc.
Impedance	50 ohms	75 ohms	300 ohms balanced
Connector	BNC input BNC output	BNC input BNC output	Special input BNC output
VSWR	1.1:1—500 mc. 1.2:1—1000 mc.	1.2:1	1.2:1

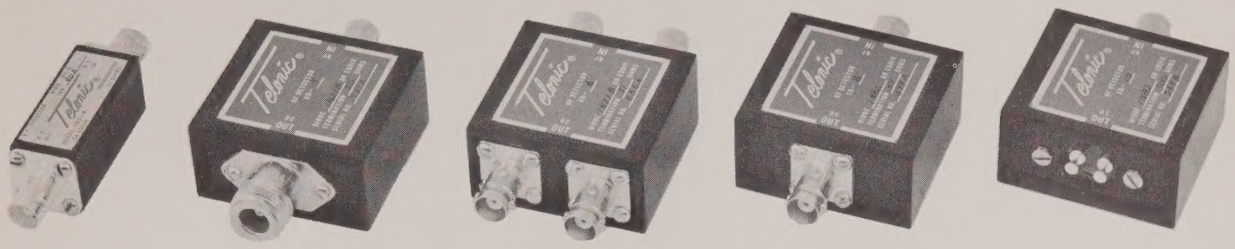
Telonic

INDUSTRIES, INC.

BEECH GROVE, INDIANA

Telonic R. F. DETECTOR XD SERIES

for Detection of R. F. Signals



XD-3 XD-5 XD-6 XD-8 XD-10

- Excellent match.
- Small size—light weight.
- Rugged construction—machined, anodized aluminum block.
- Crystals easily replaced.
- Simple, foolproof design.
- Standard resistance terminations.

These RF detectors are designed to provide the high degree of accuracy needed to fully utilize the flat output characteristics of modern-day precision sweep and signal generators.

The necessary electrical considerations for low VSWR are met while maintaining excellent mechanical factors such as: small size, light weight, rugged construction and easily-replaced diodes.

MODEL XD-3, XD-4, XD-5

The XD-3, XD-4 and XD-5 are extremely useful for a great variety of RF applications besides being used with Telonic sweep generators. The VSWR of these detectors is largely determined by the dimensions of the cavity and by the type of connectors used. The low VSWR of the XD-5 and the XD-3 is made possible by the use of a "N" type connector on the XD-5 and a special BNC connector on the XD-3. With standard polarity diodes, the output is negative.

MODEL XD-6, XD-7

These detectors are similar to the XD-3 and XD-4 except that twin circuits are used which allow choice of output voltage polarity.

MODEL XD-8, XD-9

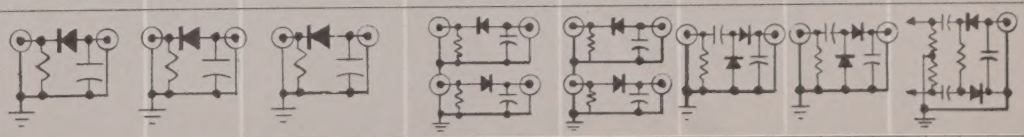
These detectors utilize a voltage doubler circuit which has the obvious advantage of higher output. The most outstanding feature is that the entire envelope of RF is detected and thus errors due to non-symmetry and waveform distortion are minimized and greater accuracy is obtained.

MODEL XD-10

This 300 ohm detector, largely of interest to the TV industry, has a termination that is balanced to ground. Since balanced detection is used, the entire envelope is detected and non-symmetry and waveform distortion errors are lessened, thus obtaining greater accuracy.

SPECIFICATIONS

Model	XD-3	XD-4	XD-5	XD-6	XD-7	XD-8	XD-9	XD-10
Frequency Range-MC.	1-1000	1-250	1-1000	1-250	1-250	1-250	1-250	1-250
Termination Ohms	51	73	50	51	75	51	75	300
VSWR:1	1.1-500 MC. 1.2-1000 MC.	1.3	1.05-500 MC. 1.1-1000 MC.	1.2-500 MC. 1.1-250 MC.	1.2	1.1	1.2	1.2
Input and Output Connections	"BNC"	"BNC"	"N" Input "BNC" Output	"BNC"	"BNC"	"BNC"	"BNC"	Special Lugs "BNC" Output
Termination Power Rating	½	½	½	½	½	½	½	½
Crystal Diodes (Other similar types may be used)	IN21B	IN21B	IN21B	IN21B	IN21B	IN82	IN82	IN82
Type	Half Wave	Half Wave	Half Wave	2 Half Wave Units	2 Half Wave Units	Voltage Doubler	Voltage Doubler	Balanced



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